

## Table of Contents

<u>Section</u>	<u>Page</u>
<b>Chapter 1 The RISC Process</b>	
1.0 Introduction.....	1-1
1.1 Definitions and Terms.....	1-2
1.1.1 Target Risk Levels .....	1-2
1.1.2 Closure .....	1-2
1.1.3 Default and Nondefault Approaches to Closure .....	1-3
1.1.4 Site and Source Area.....	1-4
1.1.5 Risk Management Policy .....	1-4
1.2 Purpose and Applicability.....	1-4
1.3 Exceptions to Using the RISC Default Approach.....	1-7
1.4 Constituent Concentration Limits.....	1-8
1.5 Exposure Pathway Evaluation .....	1-9
1.5.1 Evaluating Soil Exposure Pathways .....	1-9
1.5.2 Evaluating Ground Water Exposure Pathways.....	1-12
1.5.3 Evaluating Construction Worker Occupational Exposure .....	1-12
1.6 Background Considerations .....	1-13
1.7 Remedial Approaches .....	1-14
1.7.1 Remedial Approaches Without Institutional Controls.....	1-14
1.7.2 Remedial Approaches With Institutional Controls.....	1-15
<b>Chapter 2 Presampling Activities</b>	
2.0 Introduction.....	2-1
2.1 Applicability and Scope.....	2-1
2.2 Gathering and Reviewing Existing Site Information.....	2-2
2.2.1 Record Review .....	2-2
2.2.2 Site Visit .....	2-3
2.3 Identifying Acute Hazards .....	2-4
2.4 Identifying Preliminary Chemicals of Concern .....	2-5
2.5 Identifying Potentially Affected Media .....	2-6
2.6 Identifying Potential Exposure Pathways .....	2-7
2.7 Identifying Potential Susceptible Areas.....	2-8
2.8 Determining Present and Future Land Use.....	2-8
2.9 Classifying Areas of the Site.....	2-10
2.10 Developing a Conceptual Site Model .....	2-11

## Table of Contents (Continued)

<u>Section</u>	<u>Page</u>
<b>Chapter 3 Area Screening</b>	
3.0 Introduction.....	3-1
3.1 Applicability and Scope.....	3-1
3.2 Developing a QAPP.....	3-4
3.2.1 Data Quality Objectives (DQO).....	3-4
3.2.2 Health and Safety Plan (HASP).....	3-7
3.2.3 Sampling and Analysis Plan (SAP) .....	3-7
3.2.4 Quality Assurance/Quality Control (QA/QC) .....	3-8
3.2.5 Data Quality Assessment (DQA).....	3-8
3.3 Performing Field Activities.....	3-8
3.3.1 Types of Environmental Media .....	3-8
3.3.2 Chemical versus Petroleum Sites.....	3-11
3.3.3 Classifying Site Areas Correctly.....	3-12
3.3.4 Assessing Site Features.....	3-12
3.3.4.1 Preferential Pathways and Surface Water Erosion and Deposition .....	3-13
3.3.4.2 Environmentally Sensitive Areas.....	3-14
3.4 Sampling Procedures for Area Screening.....	3-14
3.4.1 Determining Sample Locations.....	3-14
3.4.1.1 Sampling Objectives .....	3-16
3.4.1.2 Volatile and Nonvolatile Sampling.....	3-16
3.4.2 Surface Soil Screening Procedures .....	3-17
3.4.2.1 Max Test for Nonvolatile Compounds in Areas that May Be Contaminated .....	3-18
3.4.2.2 Chen Test for Volatiles in Areas that May Be Contaminated.....	3-22
3.4.3 Subsurface Soil Screening Procedures.....	3-26
3.4.3.1 Sampling Subsurface Soils for Volatile Compounds.....	3-28
3.4.3.2 Sampling Subsurface Soils for Nonvolatile Compounds.....	3-29
3.4.4 Evaluating PEC Soil Screening Data.....	3-31
3.4.5 Ground Water Screening Procedures.....	3-32

## Table of Contents (Continued)

<u>Section</u>	<u>Page</u>
<b>Chapter 4 Characterizing the Nature and Extent of Contamination</b>	
4.0 Introduction.....	4-1
4.1 Applicability and Scope.....	4-1
4.2 Planning: Developing a Strategy to Characterize the Nature and Extent of Contamination.....	4-5
4.2.1 Update and Expand the CSM.....	4-5
4.2.2 Consider Potential Remedies and Nondefault Options.....	4-6
4.2.3 Identify Data Gaps.....	4-7
4.3 Planning: Revising a QAPP.....	4-7
4.4 Implementation: Field Investigations.....	4-9
4.4.1 Field Investigation of the Nature and Extent of Soil Contamination ....	4-10
4.4.2 Field Investigation of the Nature and Extent of Ground Water Contamination.....	4-11
4.4.2.1 Determining the Extent of Ground Water Contamination.....	4-11
4.4.2.2 Determining the Perimeter of Compliance.....	4-13
4.4.3 Field Investigation of the Nature and Extent of Contamination in Other Media.....	4-16
4.4.3.1 Surface Water.....	4-16
4.4.3.2 Sediments.....	4-16
4.4.3.3 Air.....	4-17
4.5 Assessment: Data Validation and Usability.....	4-17
<b>Chapter 5 Susceptible Areas Evaluations</b>	
5.0 Introduction.....	5-1
5.1 Geologically Susceptible Areas.....	5-1
5.2 Wellhead Protection Areas.....	5-3
5.3 Ecologically Susceptible Areas.....	5-5
5.3.1 Baseline Ecological Evaluation.....	5-7
5.3.2 Limited Ecological Assessment.....	5-8
5.3.3 Ecological Risk Assessment.....	5-9

## Table of Contents (Continued)

<u>Section</u>	<u>Page</u>
<b>Chapter 6 Closure</b>	
6.0 Introduction.....	6-1
6.1 Contaminant Additivity .....	6-2
6.1.1 Carcinogens.....	6-2
6.1.2 Noncarcinogens.....	6-3
6.2 Closure Requirements and Institutional Controls .....	6-4
6.2.1 Closure With Institutional Controls .....	6-4
6.2.2 Closure Without Institutional Controls.....	6-5
6.3 Closure Requirements by Media.....	6-5
6.3.1 Surface Soil Sampling and Data Evaluation .....	6-6
6.3.2 Subsurface Soil Sampling and Data Evaluation .....	6-7
6.3.3 Ground Water Closure Requirements .....	6-8
6.3.3.1 Closure With Ground Water Contamination .....	6-8
6.3.3.2 Source Considerations .....	6-9
6.4 Programmatic Closure Considerations .....	6-9
6.4.1 Closure Care for Engineering Controls.....	6-9
6.4.2 Financial Responsibility.....	6-9
6.4.3 Reporting.....	6-10
<b>Chapter 7 Nondefault</b>	
7.0 Introduction.....	7-1
7.1 Site-Specific Data That Can Be used in the Default Equations.....	7-3
7.1.1 Site-Specific Data for the Soil-to-Ground Water Partitioning Model .....	7-3
7.1.2 Dilution Attenuation Factor .....	7-6
7.1.3 Site-Specific Data for the Soil Saturation Limit Equation.....	7-8
7.1.4 Site-Specific Data for the Soil Attenuation Capacity Equation.....	7-8
7.1.5 Site-Specific Data for Determining the Fraction of Organic Carbon ....	7-10
7.1.6 Site-Specific Data for Dry Soil Bulk Density and Soil Porosity .....	7-11
7.2 Plume Stability and Fate and Transport Modeling .....	7-11
7.2.1 Nondefault Plume Stability.....	7-12
7.2.2 Fate and Transport Modeling.....	7-12

## Table of Contents (Continued)

<u>Section</u>	<u>Page</u>
7.3	Modifying Exposure Assumptions ..... 7-14
7.4	Institutional Controls ..... 7-15
7.5	Considering Other Pathways, Exposures, and Media Not Included in the Default..... 7-15
7.5.1	Source Areas Larger than ½ Acre..... 7-19
7.5.2	Karst and Fractured Flow Geology..... 7-19
7.5.3	Impacts on Ecologically Susceptible Areas ..... 7-20
7.5.4	Exposures of Acute or Subchronic Duration ..... 7-21
7.6	Sampling Soil and Ground Water ..... 7-21
7.7	Carcinogen Target Risk Level ..... 7-21
7.8	Noncarcinogen Additivity Approach..... 7-23
7.9	Nondefault Characterization and Closure Sampling..... 7-24
7.9.1	Presampling Activities..... 7-25
7.9.2	Horizontal Stratification..... 7-25
7.9.3	Sample Size Determination..... 7-27
7.9.3.1	Types of Samples..... 7-27
7.9.3.2	Calculating the Sample Size for Closure ..... 7-28
7.9.3.3	Other Useful Calculations Related to Sample Size..... 7-29
7.9.4	Selecting Appropriate Sample Locations..... 7-32
7.9.4.1	Selecting the Sample Coordinates for a Simple Random Sample..... 7-34
7.9.4.2	Field Procedures for Determining the Exact Sampling Location ..... 7-35
7.9.4.3	Sampling Across Depth ..... 7-35
7.9.4.4	An Example of the Simple Grid Sampling Procedure ..... 7-35
7.9.4.5	Ranked Set Sampling..... 7-36
7.9.5	Sample Collection and Analysis ..... 7-40
7.9.5.1	The Dynamic Workplan and Adaptive Sampling Process..... 7-41
7.9.5.2	Adaptive Sampling and Analysis Strategy ..... 7-44
7.9.5.3	Field Measurement for Constituents..... 7-46
7.9.5.4	Representativeness..... 7-47
7.9.5.5	Measurement Accuracy..... 7-47
7.9.6	Quality Assessment..... 7-48
7.9.7	Additional Information ..... 7-49

## Table of Contents (Continued)

<b><u>Section</u></b>	<b><u>Page</u></b>
<b>Glossary &amp; Acronym List</b> .....	G-1
<b>References</b> .....	Ref. 1

## LIST OF FIGURES

<b><u>Figure</u></b>	<b><u>Page</u></b>
1-1 The RISC Process .....	1-5
2-1 Acute Hazards.....	2-5
2-2 Potentially Affected Environmental Media .....	2-6
2-3 Examples of Exposure Pathways .....	2-8
2-4 Conceptual Site Model Diagram.....	2-12
3-1 The DQA Process .....	3-10
3-2 Three Categories of Media (?-no title on figure) .....	3-11
3-3 Example Random Sampling Pattern .....	3-21
4-1 Site Characterization Process.....	4-3
4-2 Establishing the Perimeter of Compliance.....	4-14
4-3 Off-Site POC with Property Control.....	4-14
4-4 POC without Property Control.....	4-15
5-1 Geologically Susceptible Area.....	5-2
5-2 Wellhead Protection Area .....	5-4
5-3 Ecologically Susceptible Area .....	5-6
5-4 Steps Involved in Evaluating Ecologically Susceptible Areas .....	5-8

**LIST OF TABLES**

<b><u>Table</u></b>	<b><u>Page</u></b>
2-1 Default Exposure Pathways Listed by Media and Land Use.....	2-7
2-2 Classifying Areas of the Site Prior to Surface Soil Sampling .....	2-11
3-1 Elements of a QAPP .....	3-3
3-2 DQO Process Applied to Surface Soil Screening .....	3-5
3-3 QA/QC Requirements.....	3-9
3-4 Area Screening Tests for Surface Soils .....	3-13
4-1 Minimum Number of Soil Borings to Calculate a PEC.....	4-11
6-1 Closure Documentation by Program.....	6-2
6-2 Recommended Minimum Number of Soil Sample Locations.....	6-5
7-1 Dilution Attenuation Factors.....	7-6
7-2 Default Exposure Pathways and Routes .....	7-16
7-3 Nondefault Exposure Media and Associated Pathways.....	7-18
7-4 Nondefault Sampling Criteria.....	7-22

**Appendixes**

Appendix 1 Default Closure Tables .....	A.1-1
Appendix 2 Analytical Methodology for Risk Assessment .....	A.2-1
Appendix 3 Closure by Stability Monitoring and Petroleum Closure by Attenuation Monitoring .....	A.3-1
Appendix 4 SIC Codes .....	A.4-1
Appendix 5 Institutional Controls .....	A.5-1
Appendix 6 Data Quality Objectives.....	A.6-1
Appendix 7 Land Use Guidance.....	A.7-1